

Remarks

Claims 1-27 are pending in this application. Claims 24-27 are withdrawn from consideration. Claims 14-22 are allowed. Claims 1, 7-13 and 23 stand rejected, and claims 2-6 have been objected to but have been indicated as containing allowable subject matter. Applicant believes that the invention is patentable.

Claims 1 and 23 have been amended to more particularly point out the invention. Specifically, the claims have been amended to clarify that the impedance matching layer has reduced length to the point where traveling waves are no longer present. This is in contrast to taking an elongate waveguide approach.

According to claim 1, an acoustic transducer for measuring a property of a fluid comprises an acoustic pulse generator, an impedance matching layer, and a thermal management system. The impedance matching layer is between the pulse generator and the fluid. The matching layer is formed of a low thermal conductivity material. The impedance matching layer has reduced length to the point where traveling waves are no longer present. The thermal management system is mounted to the matching layer to transfer heat from the matching layer. The thermal management system is formed of a high thermal conductivity material relative to the matching layer and is arranged along the matching layer such that substantial heat is transferred to the environment from the thermal management system without excessive temperature increase at the pulse generator.

As explained in the Background Art section of Applicant's specification, a disadvantage associated with existing buffer systems is that a short buffer has problems when operating with hot fluids, while making the buffer longer requires that the buffer guide the wave front in the desired direction. Further, solid buffers fail to effectively guide the acoustic pulse resulting in a dispersive buffer that distorts the ultrasonic pulse and limits the usefulness of the flow meter. (Page 2, ll. 6-10.)

Claims 1, 7, 9, 10 and 23 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Lynnworth (U.S. Patent No. 4,783,997). Lynnworth describes an ultrasonic transducer for high temperature applications. Lynnworth is of the type in which an electroacoustic transducer is coupled through an elongate buffer element. This elongate buffer is shown in the drawings of the Lynnworth reference. To this extent, Lynnworth fails to anticipate the invention. The claims specifically recites a combination including an impedance matching layer formed of a low thermal conductivity material and having reduced length to the point where traveling waves are no longer present. According to the claims, the thermal management system is formed of a high thermal conductivity material relative to the matching layer and is arranged in a certain way.

In contrast to Applicant's invention, Lynnworth describes an ultrasonic transducer of the elongate buffer type. This is clearly illustrated in the drawings, and it is clear that Lynnworth fails to suggest an impedance matching layer as comprehended by the claimed combinations of Applicant. Further, it is worth noting that the Examiner has pointed out the thermal conductivity of graphite as being 175 W/(m·K). The use of a steel housing/tube in Lynnworth results in an application where the thermal conductivity of the tube is much less than the thermal conductivity of the elongate graphite buffer which differs from the claimed combinations.

For reasons given above, Lynnworth clearly fails to suggest the invention. Lynnworth takes an elongate buffer approach with a relatively high thermal conductivity buffer, while the claimed invention utilizes an impedance matching layer and a special thermal management arrangement.

Claims 1, 4, 5, 8-13 and 23 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Suzuki (2002/0124662) in view of Lynnworth. This combination of references also fails to suggest the claimed invention.

Suzuki describes an ultrasonic transducer and flow meter. The Examiner acknowledges that Suzuki is deficient in that the claimed thermal management system is not suggested by Suzuki.

There is no motivation to combine these references to achieve the claimed invention. Lynnworth describes an ultrasonic transducer of the type utilizing an elongate buffer element. This approach requires that the buffer guide the wave front in the desired direction and is far different than an impedance matching layer type approach. On the other hand, Suzuki describes a short buffer approach, however, there is no motivation to combine Suzuki's teachings with teachings of Lynnworth to achieve the claimed invention.

After all, not only is there no suggestion to combine the references to achieve the claimed invention, there is a bit of uncertainty as to the combinability of these references. As Lynnworth uses an elongate buffer type approach, it is not clear that any of the teachings of Lynnworth would be readily usable in the short buffer approach of Suzuki, let alone any suggestion that such techniques would appropriately provide a sufficient thermal solution and result in a system meeting all limitations of the claims. Lynnworth addresses thermal issues by using an elongated buffer — this is a core concept of the Lynnworth device. To use any Lynnworth features in a device that takes a short buffer approach, like Suzuki, changes the fundamental operating principles of the device. On the other hand, Suzuki adopts a short buffer approach and is directed specifically to transducer manufacture, and there is no motivation to change the taught manufacture method.

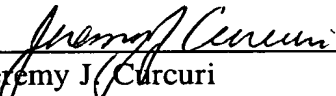
The remaining claims that have been rejected are dependent claims and are believed to be patentable for reasons given above. Applicant believe that the claims are in condition for allowance, and such action is respectfully requested.

Further, Applicant kindly reminds the Examiner that an Information Disclosure Statement with appropriate certification was mailed in accordance with rule 1.8 on November 23, 2004. In the current Office Action, the Examiner has not indicated that the references from this Information Disclosure Statement have been considered. Applicant respectfully

requests that the Examiner consider the cited references, and with the next Office paper, attach a copy of the cite listing bearing the Examiner's initials to indicate consideration of the list of references.

Respectfully submitted,

JAMES A. HILL

By 
Jeremy J. Curcuri
Reg. No. 42,454
Attorney for Applicant

Date: 3/16/05

BROOKS KUSHMAN P.C.
1000 Town Center, 22nd Floor
Southfield, MI 48075-1238
Phone: 248-358-4400; Fax: 248-358-3351